

## BROOKHAVEN NATIONAL LABORATORY PROCESS ASSESSMENT FORM

### I. General Information

Process ID:	AM-522-EAO	PEP ID# 522		
Process Name:	Electronic Assembly Operations			
Process Flow Diagrams:	<a href="#">AM-522-EAO-01</a>			
Process Description:	The process includes the Electronic Assembly Operations conducted in Buildings 902, 905 and 924 associated with the fabrication and operation of superconducting magnets and support systems at BNL. Electronic assembly refers to the installation and interconnection of wires, mechanical connectors and electronic components onto printed circuit boards and within a piece of equipment utilizing solder or conductive epoxy. Section II and the above-referenced Process Flow Diagram provide more detail on the Electronic Assembly Operations.			
Dept./Div.:	Superconducting Magnet			
Dept. Code:	AM			
Building(s):	902, 905 & 924			
Room(s):	N/A			
Point of Contact:	M. Gaffney	x8236		
Prepared by:	M. Gaffney	Reviewed by:	M. VanEssendelft	

### II. Detailed Process Descriptions and Waste Determination

Superconducting magnets are designed to bend and focus ion beams used in accelerator/collider projects at BNL and other laboratories. Superconducting Magnet Division designs, fabricates, tests and repairs superconducting magnets. The magnets are cooled to 4.6°K (and lower) using either liquid helium or supercritical helium gas. At cryogenic temperature, the magnets acquire superconducting properties, thereby greatly reducing the amount of electricity that must be supplied to generate the magnetic field.

Process Flow Diagram [AM-522-EAO-01](#), provided in Attachment 1, graphically depict the process inputs and outputs for the Electronic Assembly Operations. Dvirka and Bartilucco Consulting Engineers originally developed these diagrams to support electronic assembly operations associated with the fabrication of the Relativistic Heavy Ion Collider (RHIC). The processes are still in use and controls developed continue to be applicable.

*Note: The Muon Tracker Chambers for the PHENIX detector were assembled within clean rooms/tented areas in Building 905 and were originally included in this evaluation. The assembly of these detectors has been completed and processes are no longer applicable to SMD.*



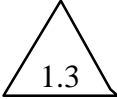


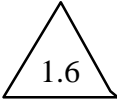
RHIC magnets and magnets for other off-site laboratories are fabricated in Buildings 902 and 924. Also located in Building 902 are shops where printed circuit boards utilized in the RHIC magnets and other components are assembled by wiring and interconnecting the various electronic components to the printed circuit boards. In addition to electronics assembly operations, Building 902 contains a small staff shop, cryogenic helium production, magnet testing systems, small-scale plating/bus-bar plating operations and the final magnet mechanical assembly operations. Magnet subassembly fabrication is also performed in Building 905.

Complete lists of chemicals utilized by the Superconducting Magnet Division are tracked using the BNL [Chemical Management System](#) (CMS). Current lists of chemical assigned to the Division can be found using the BNL CMS web site. Not all of the chemicals listed in the CMS list or located in SMD Buildings are used on a regular basis. When projects are completed, the chemicals used for that particular project typically remain in storage cabinets at the building for possible use in the future.

In general, waste generated in SMD Buildings during electronic assembly operations is reused when possible, recycled if containers are available or discarded to the regular trash. Soldering/flux fumes are typically vented through a smoke eater to ambient air.

### **III. Regulatory Determination of Process Outputs**

Electronic assembly operations conducted in SMD Buildings are similar. Wire and/or solder are used for the interconnection of printed circuit boards and electronic parts, and the assembly of the electronic parts within the magnet. Scrap wire is reused depending on the length or discarded in the regular trash. Wire is supplied on plastic spools that are reused when empty or discarded in the regular trash. Electronic components are connected to printed circuit boards using lead/tin, silver/tin or indium solder. Solder tailings are collected and either reused (by melting in solder pots) or disposed of (if contaminated to a point the reuse is not practical) as hazardous waste. Portable fan systems (with filters) are typically used to disperse the small amount of fumes from the soldering operations. If practical, soldering is performed in one of the two (2) Building 902 fume hood systems. The exhaust from these hoods operations has been categorized as trivial sources under the laboratory's NYSDEC Title V permit. Logbooks are maintained at the hoods to record the estimated emissions from this and other processes. Posting at these points list evaluated activities. Chemicals such as ethanol and acetone are stored in large (typically 5 gallon) containers within storage cabinets and are used to refill reusable plastic squirt bottles. Empty containers from other chemicals used in smaller quantities are discarded in the regular trash. Paper rags are used for cleaning and the spent rags are discarded in the regular trash.

Waste ID	Waste Description	Determination/Basis	Waste Handling	Corrective Action Required
 1.1	Wire scraps	Non-hazardous solid waste as determined by process knowledge	Waste is reused or discarded in the regular trash (due to limited amount of unused material, recycling is not warranted)	None
 1.2	Wire spools	Non-hazardous solid waste as determined by process knowledge	Waste is reused or discarded in the regular trash	None
 1.3	Soldering fumes	Non-hazardous vapors as determined by process knowledge	Vapors are dispersed to ambient air using small fans or NYSDEC permitted hoods	None
 1.4	Spent rags and empty containers	Non-hazardous solid waste as determined by process knowledge	Waste is discarded in the regular trash	None
 1.5	Waste Solder	Hazardous waste if it contains lead or silver (Satellite accumulation containers for lead and silver solder wastes establish)	Reuse if possible, or transferred to HWMF as hazardous waste for disposal	None
 1.6	Evaporative VOC emission to room	Non-hazardous fugitive emission	Released to room	None

#### **IV. Waste Minimization, Opportunity for Pollution Prevention**

Electronic assembly operations associated with SMD programs undergo a safety review by the ESH Coordinator prior to implementation. Waste minimization (and environmental compliance) is included in this review as well as during the Engineering Design Review Process (for new programs) and/or the [Work Planning and Control Process](#) (ESH Standard 1.3.6). The evaluation of waste minimization opportunities is most effective during the planning stages of an experiment or operation. In addition, all anticipated waste streams from an experiment or operation are evaluated for environmental compliance prior to implementation to ensure that the appropriate waste management procedures and facilities are in place.

During the initial effort of evaluating SMD's processes for Pollution Prevention and Waste Minimization Opportunities, each waste, effluent, and emission was examined to determine if there were opportunities to reduce either the volume or toxicity of the waste stream. Consideration was given to substitute raw materials with less toxic or less hazardous materials, process changes, reuse or recycling of materials and/or wastes, and other initiatives. These actions were documented in this section of the original process evaluation. Action taken on each of the Pollution Prevention and Waste Minimization items identified can be found in the Environmental Services Division's PEP Database. Further identification of Pollution Prevention and Waste Minimization Opportunities will be made during annual assessments of the SMD processes. If any Pollution Prevention and Waste Minimization Opportunities are identified, they will be forwarded to the Environmental Services Division for tracking through the PEP Database.

#### **IV. Assessment Prevention and Control**

During the initial effort of evaluating SMD's Assessment, Prevention, and Control (APC) Measures, operations, experiments and waste that have the potential for equipment malfunction, deterioration or operator error, and discharges or emissions that may cause or lead to releases of hazardous waste or pollutants to the environment or that potentially pose a threat to human health or the environment were described. A thorough assessment of these operations was made to determine: if engineering controls were needed to control hazards; where documented standard operating procedures needed to be developed; where routine, objective, self-inspections by department supervision and trained staff needed to be conducted and documented; and where any other vulnerability needed to be further evaluated. These actions are documented in this section of the original process evaluation. Action taken on each of the Assessment, Prevention and Control Measures is documented in the Environmental Services Division's PEP Database. Further identification of Assessment, Prevention and Control Measures will be made during annual assessments of SMD processes. If any Assessment, Prevention and Control Measures are identified, they will be forwarded to the Environmental Services Division for tracking through the PEP Database.

ATTACHMENT 1

PROCESS FLOW DIAGRAMS

AM-522-EAO-01